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Makino

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[54] **INPUT CONTROL FOR RADIO SELECTIVE CALLING RECEIVER**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**^{6} **H04Q 1/00**

[52] **U.S. Cl.** **340/825.44**; 341/24

[58] **Field of Search** 340/825.44, 825.36; 455/38.1; 341/24

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[57] **ABSTRACT**

A selective calling receiver includes a keypad for inputting an instruction according to a user's manual operation and a detector for detecting an incoming call addressed to the selective calling receiver itself. A notifying circuit notifies reception of the incoming call to a user through sound, light, and/or vibration. When the incoming call is detected, a control processor transfers control to an incoming call notifying routine and, at the same time, ignores the instruction received from the keypad during a predetermined time period immediately after the incoming call has been detected. After the predetermined time period has passed, the instruction due to the user's manual operation is enabled again.

17 Claims, 4 Drawing Sheets

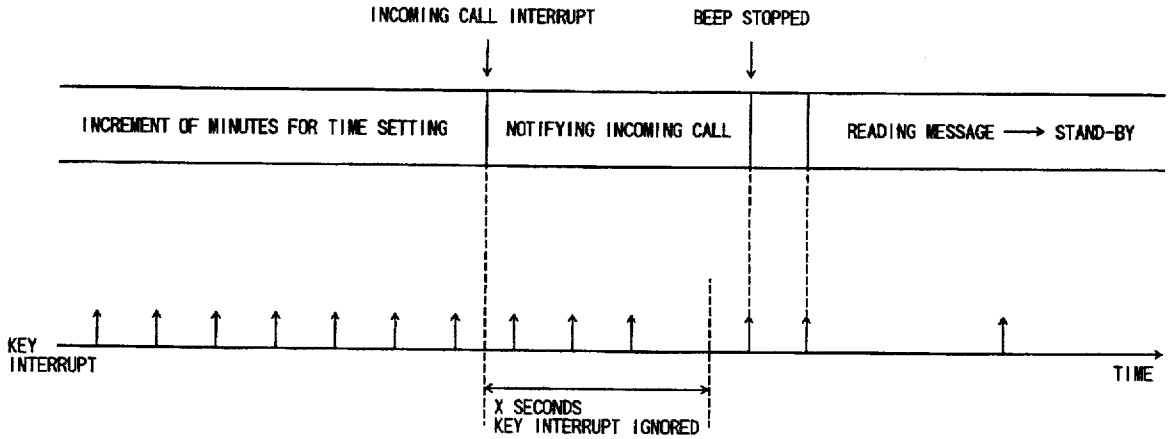


FIG. 1 (PRIOR ART)

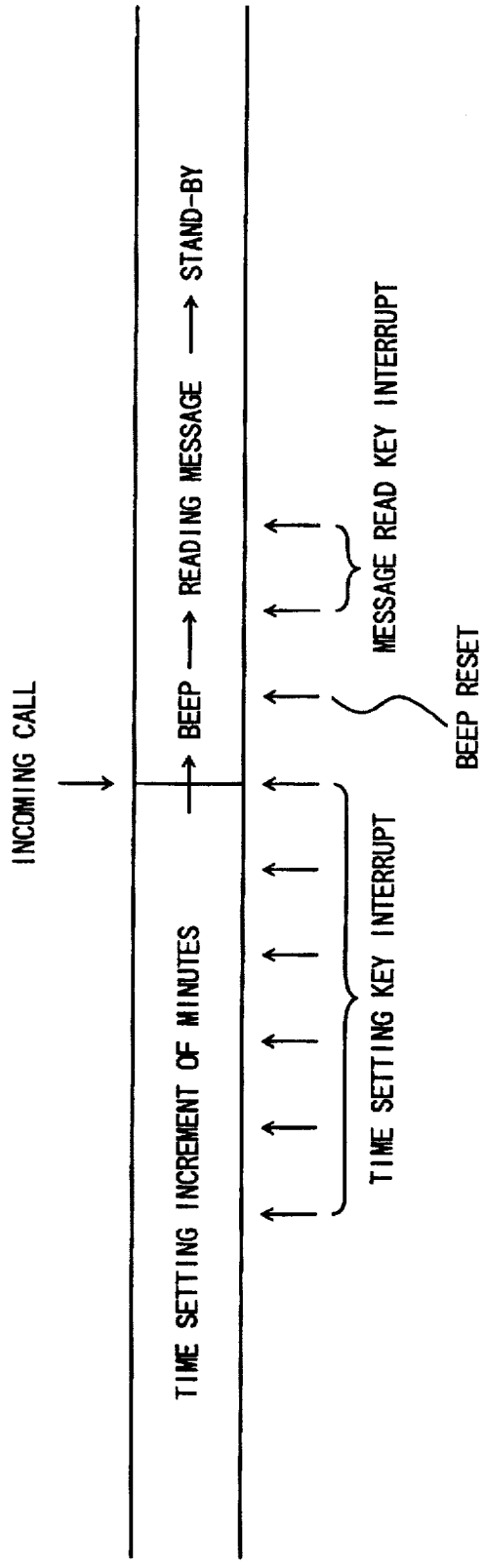


FIG. 2

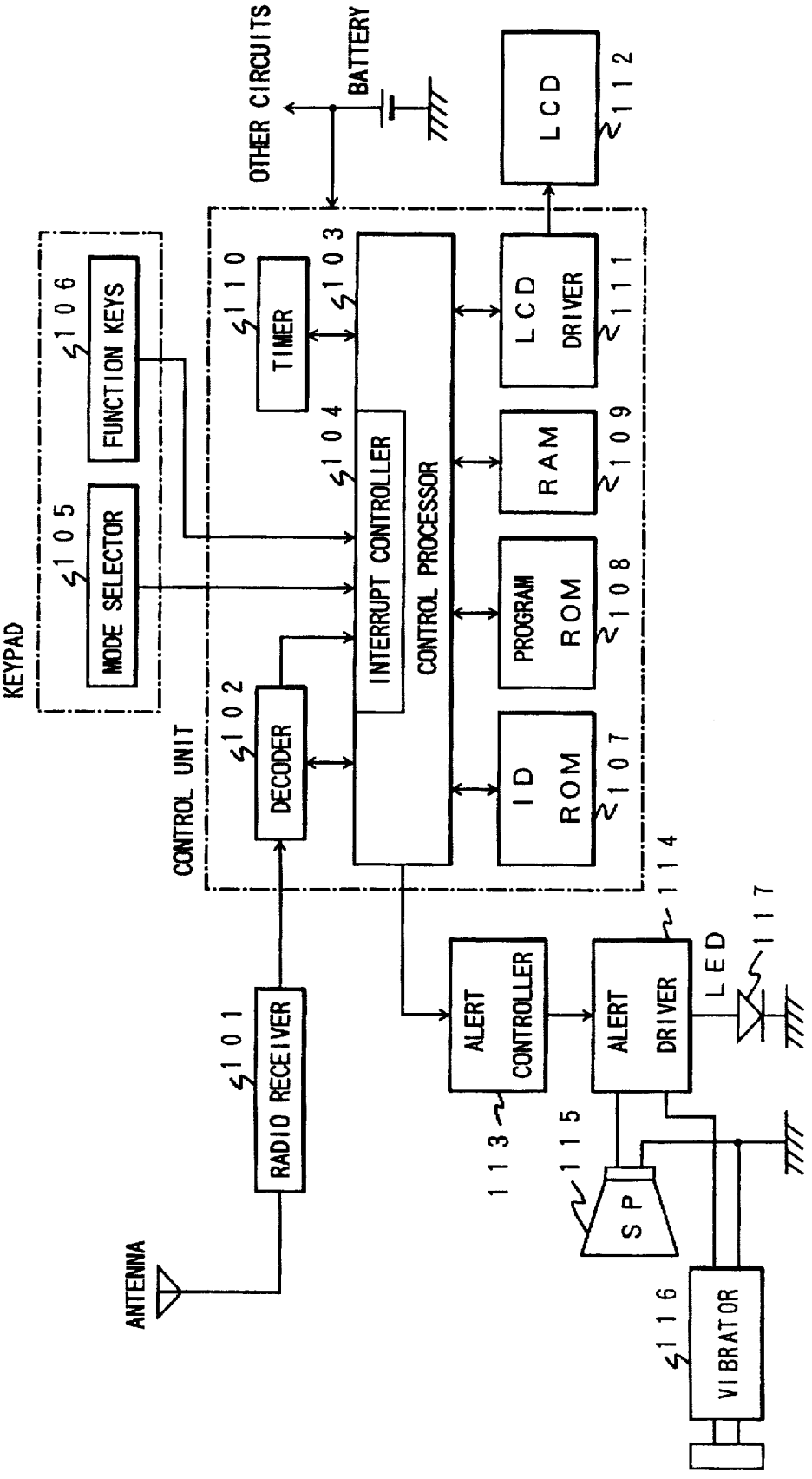

OTHER CIRCUITS
BATTERY
LCD
112
KEYPAD
106
FUNCTION KEYS
105
MODE SELECTOR
110
TIMER
103
INTERRUPT CONTROLLER
CONTROL PROCESSOR
LCD DRIVER
111
104
RAM
109
PROGRAM ROM
108
ID ROM
107
CONTROL UNIT
102
DECODER
101
RADIO RECEIVER
ANTENNA
ALERT CONTROLLER
113
ALERT DRIVER
114
LED
117
115
SP
116
VIBRATOR

FIG. 3

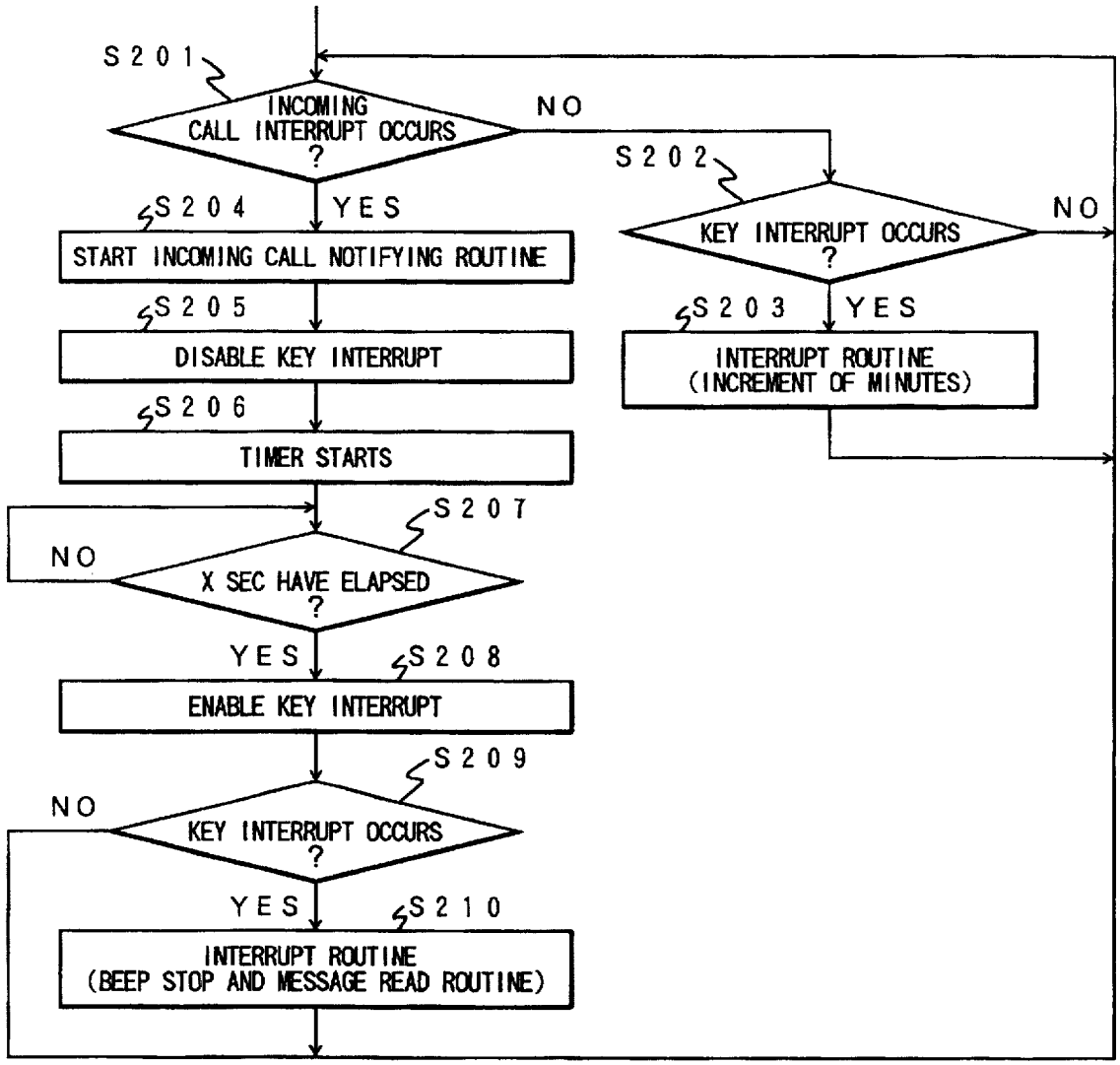
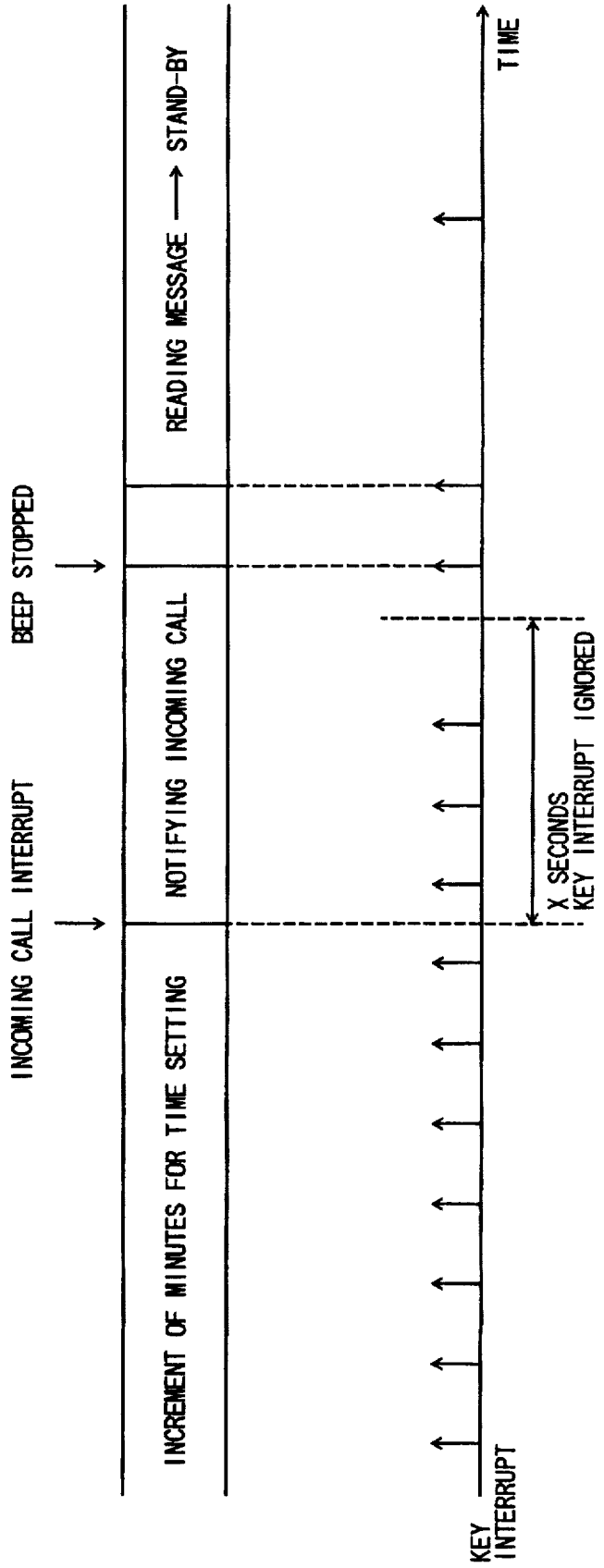

S201
INCOMING CALL INTERRUPT OCCURS ?
NO
S202
KEY INTERRUPT OCCURS ?
NO
YES
S203
INTERRUPT ROUTINE (INCREMENT OF MINUTES)
S204
YES
START INCOMING CALL NOTIFYING ROUTINE
S205
DISABLE KEY INTERRUPT
S206
TIMER STARTS
S207
NO
X SEC HAVE ELAPSED ?
YES
S208
ENABLE KEY INTERRUPT
S209
NO
KEY INTERRUPT OCCURS ?
YES
S210
INTERRUPT ROUTINE (BEEP STOP AND MESSAGE READ ROUTINE)

FIG. 4


INCREMENT OF MINUTES FOR TIME SETTING
INCOMING CALL INTERRUPT
NOTIFYING INCOMING CALL
BEEP STOPPED
READING MESSAGE → STAND-BY
TIME
X SECONDS
KEY INTERRUPT IGNORED
KEY INTERRUPT

INPUT CONTROL FOR RADIO SELECTIVE CALLING RECEIVER

BACKGROUND OF THE INVENTION

1. Field of the invention

The present invention generally relates to a radio selective calling receiver, and in particular to a method and system for informing the user of an incoming call with reliability.

2. Description of the Related Art

A selective calling receiver has been widely used for various purposes and, especially, a small-sized and light-weight selective calling receiver called a pager is suitable for being taken on the road. A basic function of the selective calling receiver is to indicate by beep sound, vibration, or light the incoming call and then to display a received message on an liquid-crystal display (LCD) according to the user's key operation. Since the incoming call notifying function has the highest priority, the interrupt of the incoming call can occur in the middle of performing another function. Further, in order to save space, a plurality of operation modes usually share the use of the same key.

Since any incoming call occurs suddenly, however, the user cannot know in advance when an incoming call occurs, resulting in a problem of operability as follows.

As showing in FIG. 1, assuming that the user is setting a time-of-day clock by pressing a key again and again. Each time the key is pressed in a time setting mode, the number of the minute digit, for example, is incremented. When an incoming call occurs, however, control is forced to be transferred to the incoming call notifying mode in the progress of setting the time-of-day clock. In cases where the use of that key is shared, the notifying routine is progressed unless the user stops pressing the key. More specifically, referring to FIG. 1, when the user presses the key just after the incoming call has occurred, the beeping sound is reset. On subsequently pressing the key several times, a received message is read and displayed on the LCD, and then the operation state is changed to a stand-by state after all the message has been displayed. Such a sequence may give the user the impression that an initial stand-by screen suddenly appears due to some mistake.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a radio selective calling receiver and its control method which permit the user to control the incoming call notifying process with reliability.

Another object of the present invention is to provide a control method which achieves reliable operability even when an incoming call suddenly occurs in the middle of the user's key operation.

According to the present invention, any instruction due to the user's manual operation is ignored during a predetermined time period just after an incoming call occurs. More specifically, a selective calling receiver according to the present invention is provided with an input means for inputting an instruction according to a user's manual operation and a detector for detecting an incoming call from a selective calling signal, the incoming call being addressed to the selective calling receiver itself. Further, the selective calling receiver is provided with a notifying circuit and a controller. The notifying circuit notifies reception of the incoming call to a user through at least one predetermined medium such as sound, light, and/or vibration. The controller ignores the instruction received from the input means during a predetermined time period immediately after the incoming call has been detected.

The controller is preferably implemented by a base program stored in a program memory. The program memory further stores a plurality of function programs one of which is executed in accordance with the user's manual operation. The input means comprises a plurality of keys including at least one key which is shared by a plurality of programs among the base program and the function programs.

The selective calling receiver is further provided with an interrupt controller and a receiver controller. The interrupt controller assigns a higher priority to a first interrupt of the incoming call than a second interrupt of the instruction and ignoring the second interrupt of the instruction until a predetermined time period has elapsed immediately after the incoming call has been detected. The receiver controller activates the notifying circuit from when the incoming call is detected until the second interrupt of the instruction first occurs after the predetermined time period has elapsed.

Preferably, the receiver controller controls the notifying circuit such that a message including in the incoming call is displayed on screen when the second interrupt of the instruction secondly occurs after the predetermined time period has elapsed.

According to another aspect of the present invention, when the incoming call is detected, control is changed from a first operation mode determined by the instruction to a second operation mode which provides a first step such that the incoming call is notified to a user through a predetermined medium. At the same time, the instruction due to the user's manual operation is ignored until a predetermined time period has elapsed immediately after the incoming call is detected, and the first step is performed from when the incoming call is detected until the instruction first occurs after the predetermined time period has elapsed. Preferably, the second operation mode provides a second step of displaying a message including in the incoming call on screen when the instruction secondly occurs after the predetermined time period has elapsed.

As described above, according to the present invention, the user's manual operation is ignored for a predetermined time period after an incoming call is detected. Therefore, the user's misoperation is effectively prevented even When an incoming call suddenly occurs. In addition, the user can confirm the occurrence of the incoming call before manually operating the input means to stop the notifying circuit working and display the received message on screen. In other words, the incoming call notifying process is progressed by the user with reliability.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a time chart showing an example of the operation of a conventional radio selective calling receiver;

FIG. 2 is a block diagram showing a radio selective calling receiver according to an embodiment of the present invention;

FIG. 3 is a flowchart showing the operation of an interrupt control according to the embodiment; and

FIG. 4 is a time chart showing an example of the operation of the embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, there is shown a selective calling receiver in accordance with the present invention. The

selective calling receiver is comprised of a radio system and a control unit which is connected to a battery, a key pad, a liquid-crystal display (LCD), and an alert circuit. The radio system is comprised of a built-in antenna and a radio receiver **101**. The receiver **101** receives an FSK (Frequency Shift Keying)-modulated radio signal from a radio base station (not shown) of a selective calling system through the antenna. The receiver **101** further includes an FSK demodulator which demodulates the received radio signal into a baseband signal. After the waveform of the baseband signal is shaped, the wave-shaped signal is transferred as a selective calling signal from the radio receiver **101** to a decoder **102**. The decoder **102** receives the selective calling signal from the radio receiver **101** and decodes it into received data. In this embodiment, the decoder **102** further compares the selective calling number included in the received data with the identification (ID) number previously stored in an ID ROM **107** under the control of a control processor **103**. When the selective calling number included in the received data is identical to the ID number, the decoder **102** outputs a message included in the received data to the control processor **103**.

The control processor **103** receives not only the received message from the decoder **102** but also user's key instructions from a key pad including a mode selector **105** and other function keys **106**. As described before, a plurality of operation modes share the use of the same key for space-saving. The control processor **103** implements an interrupt controller **10** based on the operating program. The interrupt controller **104**, as described later, assigns the top priority to the interrupt request of the decoder **102** for the received message processing. The operating program, other function programs, and fonts for display on screen are stored in a program read-only memory (ROM) **108**.

When the interrupt for the message reception occurs, the interrupt controller **104** ignores user's key instructions received from the keypad for a predetermined time period. At the same time, the received message is stored onto a random access memory (RAM) **109** and the alert circuit is activated according to a selected informer mode. The control processor **103** uses a timer **110** to check whether a lapse of time reaches the predetermined time period during which the user's key instructions are ignored as described in detail later.

By the user pressing a function key in a message read mode, the control processor **103** reads the message from the RAM **109** and controls the LCD driver **111** using the font stored in the program ROM **107** so that the message is displayed on the LCD **112**. When the interrupt for the message reception occurs, the control processor **103** controls the alert controller **113** so that a selected alert device is activated. More specifically, if the user selects a beep mode, the alert controller **113** controls an alert driver **114** so that a speaker **115** makes a beep and an light-emitting diode (LED) **117** blinks. If a silent mode is selected, a vibrator **116** generates mechanical vibrations and the LED **117** blinks.

An interrupt control method according to the present invention will be described hereinafter in the case where the user is setting a time-of-day clock by pressing a certain function key again and again.

Referring to FIG. **3**, the control processor **103** checks at all times whether an incoming call interrupt and a key interrupt occur with higher priority assigned to the incoming call interrupt. More specifically, it is checked whether an incoming call interrupt occurs (step **S201**) and , if no incoming call occurs, then checked whether a key interrupt occurs (step **S202**). Since the user is pressing the key to set the time-of-day clock here, the number of minute digit of the time-of-day clock is incremented each the key is pressed unless an incoming call occurs (step **S203**).

When the received message is input from the decoder **102** to the interrupt controller **104**, control is forced to be transferred to an incoming call notifying routine in the progress of setting the time-of-day clock (step **S204**). After starting the incoming call notifying routine, the control processor **103** disables the key interrupt (step **S205**) and then starts the timer **110** which is set to X seconds, where X is a value selected from 0.5, 1.0, 1.5, and so on (step **S206**). Since the key interrupt is ignored during this X-second period, the user's key operation has no effect on the incoming call notifying routine. When the X-second period has passed (YES in step **S207**), the control processor **103** enables the key interrupt again (step **S208**). Therefore, when the user presses the key (YES in step **S209**), the control processor **103** transfers control to a predetermined interrupt routine (step **S210**). Since the incoming call notifying routine is now performed, the user's key operation causes the alert controller **113** to stop the alert process and then the control processor **103** to read the message from the RAM **109** to display it on the LCD **112**.

As illustrated in FIG. **4**, in the case where the user is pressing the key again and again to set the time-of-day clock, the control processor **103** starts the incoming call notifying routine at the time when receiving the message from the decoder **102**. At the same time, the control processor **103** disables the key interrupt for X seconds during which the user's key operations are ignored, resulting in no effect on the incoming call notifying routine. After the X-second period has elapsed, the control processor **103** enables the key interrupt again, thereby restoring the user's key operations. Therefore, when the user presses the key once just after the X-second period has elapsed, the control processor **103** controls the alert controller **113** so as to stop making a beep. And then the following user's key operations cause the control processor **103** to read the message from the RAM **109** to display it on the LCD **112** and, if all messages have been displayed, then the control processor **103** returns to the stand-by state.

The X-second period during which the user's key operations are ignored is preferably determined so that the user is prevented from mistakenly pressing the key and the beep is stopped as soon as possible. For example, the time period X is set to about 2 seconds.

As described above, according to the present invention, the user's key interrupt is ignored for a predetermined time period after an incoming call is detected. Therefore, the user's misoperation is effectively prevented even when an incoming call suddenly occurs. Since the user can confirm the occurrence of the incoming call before pressing the key to stop the beep and display the received message on screen, the incoming call notifying process is progressed under the control of the user with reliability.

What is claimed is:

1. A selective calling receiver for receiving a selective calling signal, comprising:

input means for inputting an instruction according to a user's manual operation;

detecting means for detecting-an incoming call from the selective calling signal, the incoming call being addressed to the selective calling receiver itself;

notifying means for notifying reception of the incoming call to a user through a predetermined medium; and

control means for ignoring the instruction received from the input means during a predetermined time period immediately after the incoming call has been detected.

2. The selective calling receiver according to claim 1, wherein the control means comprises:

first means for receiving a first interrupt request for the incoming call and a second interrupt request for the instruction;

second means for assigning a higher priority to the first interrupt request for the incoming call than the second interrupt request for the instruction; and

third means for ignoring the second interrupt request for the instruction during the predetermined time period immediately after the incoming call has been detected.

3. The selective calling receiver according to claim 1, further comprising:

storage means for storing a base program and a plurality of function programs, the base program providing basic operations of the selective calling receiver; and

processing means for executing the base program in which the control means is implemented and executing one of the function programs depending on the instruction corresponding to the user's manual operation.

4. The selective calling receiver according to claim 1, wherein the input means comprises a plurality of keys which allow the user's manual operation.

5. The selective calling receiver according to claim 1, wherein the input means comprises a plurality of keys including at least one key which is shared by a plurality of programs among the base program and the function programs.

6. A selective calling receiver comprising:

input means for inputting an instruction according to a user's manual operation;

receiving means for receiving a selective calling signal;

detecting means for detecting an incoming call from the selective calling signal, the incoming call being addressed to the selective calling receiver itself;

notifying means for notifying reception of the incoming call to a user through a predetermined medium;

interrupt control means for assigning a higher priority to a first interrupt of the incoming call than a second interrupt of the instruction and ignoring the second interrupt of the instruction until a predetermined time period has elapsed immediately after the incoming call has been detected; and

receiver control means for activating the notifying means from when the incoming call is detected until the second interrupt of the instruction first occurs after the predetermined time period has elapsed.

7. The selective calling receiver according to claim 6, further comprising:

storage means for storing a base program and a plurality of function programs, the base program providing basic operations of the selective calling receiver; and

processing means for executing the base program by which the interrupt control means and the receiver control means are implemented therein and executing one of the function programs depending on the instruction corresponding to the user's manual operation.

8. The selective calling receiver according to claim 7, wherein the input means comprises a plurality of keys including at least one key which is shared by a plurality of programs among the base program and the function programs.

9. The selective calling receiver according to claim 6, wherein the receiver control means controls the notifying means such that a message including in the incoming call is displayed on screen when the second interrupt of the instruction secondly occurs after the predetermined time period has elapsed.

10. The selective calling receiver according to claim 7, wherein the receiver control means controls the notifying means such that a message including in the incoming call is displayed on screen when the second interrupt of the instruction secondly occurs after the predetermined time period has elapsed.

11. A receiving control method of a selective calling receiver having a keypad for inputting an instruction according to a user's manual operation, comprising the steps of:

a) detecting an incoming call from the selective calling signal, the incoming call being addressed to the selective calling receiver itself;

b) notifying reception of the incoming call to a user through a predetermined medium; and

c) ignoring the instruction received from the keypad during a predetermined time period immediately after the incoming call has been detected.

12. The receiving control method according to claim 11, wherein the step (c) comprises the steps of:

receiving a first interrupt request for the incoming call and a second interrupt request for the instruction;

assigning a higher priority to the first interrupt request for the incoming call than the second interrupt request for the instruction; and

ignoring the second interrupt request for the instruction during the predetermined time period immediately after the incoming call has been detected.

13. A receiving control method of a selective calling receiver having a keypad for inputting an instruction according to a user's manual operation, comprising the steps of:

a) detecting an incoming call from a selective calling signal, the incoming call being addressed to the selective calling receiver itself;

b) ignoring the instruction received from the keypad until a predetermined time period has elapsed immediately after the incoming call has been detected; and

c) notifying reception of the incoming call to a user through a predetermined medium from when the incoming call is detected until the instruction first occurs after the predetermined time period has elapsed.

14. The receiving control method according to claim 13, wherein the step (c) further comprises the step of displaying a message including in the incoming call on screen when the instruction secondly occurs after the predetermined time period has elapsed.

15. The receiving control method according to claim 13, further comprising the step of assigning a higher priority to a first interrupt of the incoming call than a second interrupt of the instruction.

16. A receiving control method of a selective calling receiver having a keypad for inputting an instruction according to a user's manual operation, comprising the steps of:

a) detecting an incoming call from a selective calling signal, the incoming call being addressed to the selective calling receiver itself;

b) changing control from a first operation mode determined by the instruction to a second operation mode when the incoming call is detected, the second operation mode providing a first step such that the incoming call is notified to a user through a predetermined medium;

c) ignoring the instruction until a predetermined time period has elapsed immediately after the incoming call is detected; and

d) performing the first step from when the incoming call is detected until the instruction first occurs after the predetermined time period has elapsed.

17. The receiving control method according to claim **16**, wherein the second operation mode provides a second step of displaying a message including in the incoming call on screen when the instruction secondly occurs after the predetermined time period has elapsed.

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